

REDISCOVERY OF *PRIMOVULA (P.) HELENEAE* CATE AND DESCRIPTION OF A NEW SPECIES OF *CRENAVOLVA* FROM SOUTH AUSTRALIA (MOLLUSCA: GASTROPODA: OVULIDAE)

by K. L. GOWLETT-HOLMES* & N. J. C. HOLMES†

Summary

GOWLETT-HOLMES, K. L. & HOLMES, N. J. C. (1989) Rediscovery of *Primovula (P.) heleneae* Cate and description of a new species of *Crenavolva* from South Australia (Mollusca: Gastropoda: Ovulidae). *Trans. R. Soc. S. Aust.* 113(4), 205-214, 30 November, 1989.

The first five collected specimens of the South Australian allied cowrie *Primovula (P.) heleneae* Cate, 1973 are recorded. This species, previously known from a single shell collected prior to 1908, is redescribed, and details of the animal and its habitat given. *Crenavolva cruenta* sp. nov., is described from Spencer Gulf, S.A.; it most closely resembles *C. striatula* and *C. verconis* but is distinguished by its more elongate form, more produced ends and colour pattern.

KEY WORDS: Gastropoda, Ovulidae, South Australia, *Primovula heleneae*, *Crenavolva*, new species, habitat.

Introduction

Three species of the allied cowrie family Ovulidae are recorded from South Australia: *Crenavolva verconis* (Colton & Godfrey, 1932), *Primovula (P.) heleneae* Cate, 1973, and an *Aclyvolva* sp. (Coleman 1981). All are regarded as very rare. The first two species are known from single specimens dredged dead prior to 1908 (Verco 1908, as *Ovula formosa*).

Off Douglas Point in northern Spencer Gulf, S. Aust., one of us (NJCH) found a number of allied cowries living on fans of the gorgonian corals *Euplexaura* sp. and *Echinogorgia* sp. in 10-15 m depth. These specimens were identified as *Primovula (P.) heleneae* Cate, 1973, (living on *Euplexaura* sp.), and an undescribed species of *Crenavolva*, (living on *Echinogorgia* sp.). Here we describe the new species of *Crenavolva*, redescribe *P. (P.) heleneae*, and include details of the animal and its habitat.

Materials and Methods

The material reported here is deposited in the South Australian Museum, Adelaide (SAM), Australian Museum, Sydney (AM), Museum of Victoria, Melbourne (NMV), Northern Territory Museum of Arts & Sciences, Darwin (NTM), Queensland Museum, Brisbane (QM), Western Australian Museum, Perth (WAM), Tasmanian Museum and Art Gallery, Hobart (TM) and National Museum of New Zealand, Wellington (NMNZ). Living material was collected by "SCUBA" and "Hookah" diving and using a Smith-McIntyre grab dredge. Underwater photographs of the living animals were taken using Nikonos III and Nikonos V cameras with macro extension

tubes and electronic flash units. Wet material was preserved in 75% methylated ethanol solution or 2% formalin/propylene glycol solution. Radulae were prepared for examination under scanning electron microscope (SEM) after the method of Bandel (1984). Colour descriptions follow Komerup & Wanschei (1978).

Primovula (Primovula) heleneae Cate, 1973
FIGS 1, 3, 4.

Ovula formosa Verco, 1908, p. 342 (non Adams & Rees, 1848).

Prosimnia verconis: Cotton & Godfrey, 1932; p. 46, pl. 1, fig. 15 (in part).

Pellissimnia verconis: Iredale, 1935, p. 105; Cotton, 1959, p. 368, (in part).

Primovula (Primovula) verconis: Schülder, 1941, p. 107, (in part).

Neosimnia (Pellissimnia) verconis: Allan, 1956, p. 130, pl. 14, fig. 40 (in part).

Primovula (Primovula) heleneae Cate, 1973a; p. 43-4, fig. 89.

Type: Holotype (SAM D15943), part of the type series examined by Cotton & Godfrey (1932); a paratype of *Prosimnia verconis*.

Type locality: Holotype dredged in Gulf St Vincent or Spencer Gulf, S. Aust., by J. C. Verco; the holotype of *P. verconis* was dredged off St Francis Island, S. Aust., by J. C. Verco.

Other material: SAM D17973 (4 + eggs, in spirit), SAM D17975 (2, dry) Douglas Point, northern Spencer Gulf, S. Aust., N. J. C. Holmes, 17.vi.1987; SAM D18434 (13, dry), SAM D18435 (8, in spirit) Douglas Point, northern Spencer Gulf, S. Aust., N. J. C. Holmes, 5.v.1988.

Species description: Small allied cowrie, adult length 9.15-13.80 mm, mean 10.77 mm \pm 1.004. Elongate; both ends slightly produced, posterior end more so; widest part of dorsum in posterior $\frac{1}{2}$ (Fig. 3E).

* South Australian Museum, North Terrace, Adelaide, S. Aust. 5000

† Kinhill Marine Sciences, 200 East Terrace, Adelaide, S. Aust. 5000.



Fig. 1. *Primovula (P.) heleneae*, two adults, one with partially extended mantle, on the gorgonian coral *Euplexaura* sp.



Fig. 2. *Crenavolva cruenta* sp. nov., two adults with partially extended mantles on the gorgonian coral *Echinogorgia* sp.

Dorsum (Fig. 3A) sculptured with numerous transverse wavy striae; funiculum prominent, with three weak transverse ridges. Base (Fig. 3B) concave, outer lip and parietal-columellar lip flat and inward sloping; aperture narrow with a strong fossula, both sides strongly calloused. Parietal-columellar base smooth but with body whorl striae visible beneath the callus. Outer lip with weak transverse ridges posteriorly, inner margin slightly dentate posteriorly; outer margin with three to ten slight to prominent nodules at posterior end, more prominent in smaller shells; usually with one to three slight nodules at anterior end.

Posterior canal somewhat produced, with a basally projecting terminal knob dividing canal into distinct left and right channels (Figs 3C, 3D). Anterior canal shallow "U"-shaped, slightly flaring and turned to the right, bordered on both sides by distinct and slightly projecting terminal ridges.

Shell pastel red to pale orange to greyish yellow, anterior and posterior tips usually orange; paler band across widest part of dorsum; columellar callus, outer lip and labial callus all paler than dorsum.

Animal mantle lobes (Fig. 1) with no papillae; translucent pastel red to dark orange, with irregular, reddish brown patches varying in size, area immediately around each patch not patterned, remainder of mantle patterned with slightly raised, white dots. Foot pinkish white; anterior dorsal foot with a series of prominent, vertical lamellae; posterior dorsal foot with a longitudinal, violet brown to brown stripe. Tentacles with white tip for 1/6 length, violet brown for almost half length, remainder pinkish white with basal 1/5 from eye swollen, with violet brown stripe from eye to base. Siphon and proboscis violet brown to brown.

Radula (Fig. 3F) with central teeth narrow at base, with large, broad, flat heads, outer edge with many perpendicular, sharp cusps, central cusp very large, narrow at base, widening for about half length, where there is usually a lateral denticle on at least one side, then narrowing apically to sharp point; with eight or nine small cusps on either side of central one. First lateral teeth elongate, strongly curved, heads tricuspidate, cusps uneven, central cusp largest. Second lateral teeth elongate, with broad, flat heads, heads with about five long, curved, sharp-tipped cusps.

Egg mass (Fig. 4A) with 57 colourless, transparent, jelly-like capsules laid on a single branch of the host sequentially in an elongated spiral and fused together. Each capsule contains many white-shelled embryos, shells wider than long, shell length 150–230 μm , shell round, punctate, with thin operculum (Figs 4B, 4C).

Range: The new material examined here is from northern Spencer Gulf, S. Aust. Cate (1973a) gave the type locality of *P. (P.) heleneae* as the "S. end of St Vincent Gulf, South Australia. (34°55'S 138°10'E)", but the holotype is labelled in Verco's handwriting "G. St Vincent or Spencer Gulf, dredged", so Cate's (1973a) restriction of the type locality is suspect. The range of this species is assumed to be central S. Aust. It is noteworthy that Cotton (1935) refers to the occurrence of *Crenavolva verconis* in southern W.A., but we can find no specimens to substantiate it. Cate (1973a) refers Cotton's (1935) reference to a Queensland species, *Primovula (P.) platysia* Cate, 1973 (as *Ovula formosa* Verco), but does not mention if he examined the specimens.

Habitat: On fans of the gorgonian coral *Euplexaura* sp. (Cnidaria: Octocorallia: Plexauridae), in areas of strong tidal movement.

Remarks: The specific identity of the host coral (SAM H355) could not be determined (P. Alderslade pers. comm.). The white spicules (Fig. 5C) are typical of *Euplexaura*. In northern Spencer Gulf, colonies (Fig. 5A) are multibranching fans in one plane perpendicular to the strong tidal currents, they are attached by a thickened base to a large shell fragment or other piece or pieces of solid debris in the substrate; a poorly sorted, silty, shelly sand. Colonies are relatively large (ca 30 cm high), and widely and irregularly dispersed at 10–20 m depth. Distribution appears to be associated with tidal current velocity and substrate siltiness, *Euplexaura* sp. appears to be less tolerant of silt than *Echinogorgia* sp., and is less common. Each *Euplexaura* sp. colony usually hosts two to five individuals of *P. (P.) heleneae*. Polyps are usually withdrawn during daylight on all of the colony regardless of the presence of *P. (P.) heleneae*. Orientation of the shell is always with the longitudinal axis parallel to the branches of the host, with no observed preference for a head up or head down attitude. No particular position on the host is favoured, and adults and juveniles are present together. Eggs have been observed in late autumn and early winter, laid on a single branch of the host and not attended by the parent, although adults were present on the host.

The colour pattern of the extended mantle lobes of *P. (P.) heleneae* is almost identical to that of *Euplexaura* sp. The background colour of the coral is pastel red, and the withdrawn polyps are red to reddish brown. The pattern of reddish brown patches on the mantle lobes of *P. (P.) heleneae* mimics the position of the polyps on the coral, and an animal with the mantle lobes fully extended is

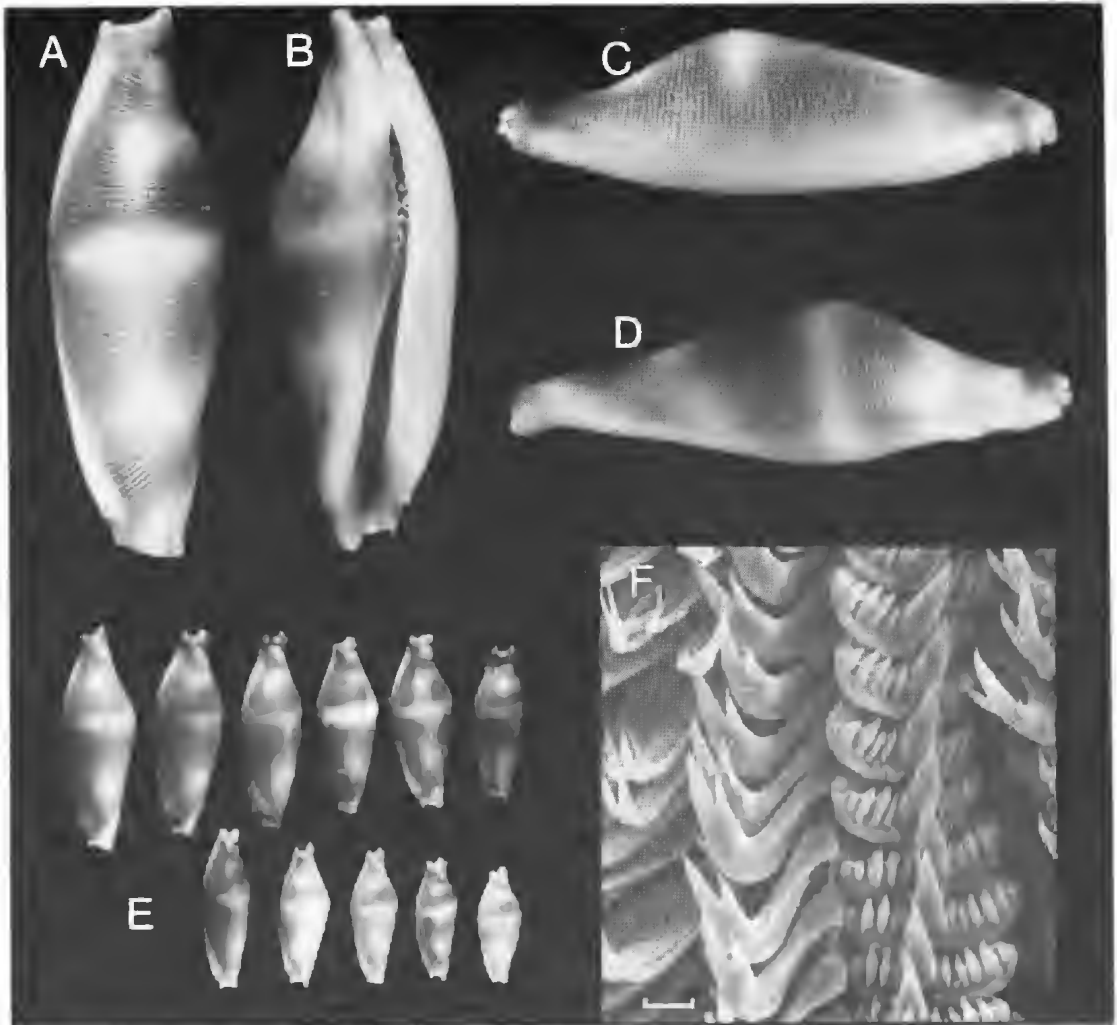


Fig. 3. *Primavula (P.) heleneae* (SAM D17975). A. dorsal view, x 7.5; B. ventral view, x 7.5; C & D. lateral views, x 7; E. size range, x 2.5 (SAM D18434); F. radula, scale bar = 10 µm (SAM D17973).

very well camouflaged. The very close mimicry by *P. (P.) heleneae* of its host suggests that it is an obligate predator and that its distribution will be limited by that of *Euplexaura* sp. The distances between colonies of *Euplexaura* sp. (10's of metres) suggest that adults of *P. (P.) heleneae* would not move between colonies, so dispersal is probably by a free-swimming veliger stage of short duration.

***Crenavolva cruenta* sp. nov.**
FIGS 2, 7.

Holotype: SAM D18431, dry adult specimen 10.45 x 3.60 x 3.00 mm, collected on the gorgonian coral *Echinogorgia* sp. at 15 m depth, 1.6 km E. of Douglas Point, northern Spencer Gulf, S. Aust., 32°51'48"S, 137°49'12"E, by N. J. C. Holmes, 5.v.1988.

Paratypes: Same locality data as holotype. Spirit specimens: SAM D18433, 14 juv., 4.65–9.60 mm, 24 ad., 7.35–11.65 mm. Dry specimens: SAM D18432, six juv., 6.30–9.15 mm, 27 ad., 7.15–12.35 mm. SAM D18437, 11 ad., 6.70–12.60 mm. AM C156094, two ad., 9.55 and 10.90 mm respectively. NTM P1384, two ad., 9.45 and 10.20 mm respectively. NMV F52836, two ad., 9.35 and 9.95 mm respectively. QM MO.19385, two ad., 9.40 and 9.70 mm respectively. TM EI7744, two ad., 9.15 and 9.35 mm respectively. WAM 152/88, two ad., 8.30 and 10.30 mm respectively. NMNZ MF. 49494, two ad., 8.65 and 10.60 mm respectively.

Other material examined: Two broken specimens in spirit from Douglas Bank northwest, northern Spencer Gulf, S. Aust., 32°47'18"S, 137°49'12"E, E. Oks, Sept. 1987 (SAM D17976); Backy Point

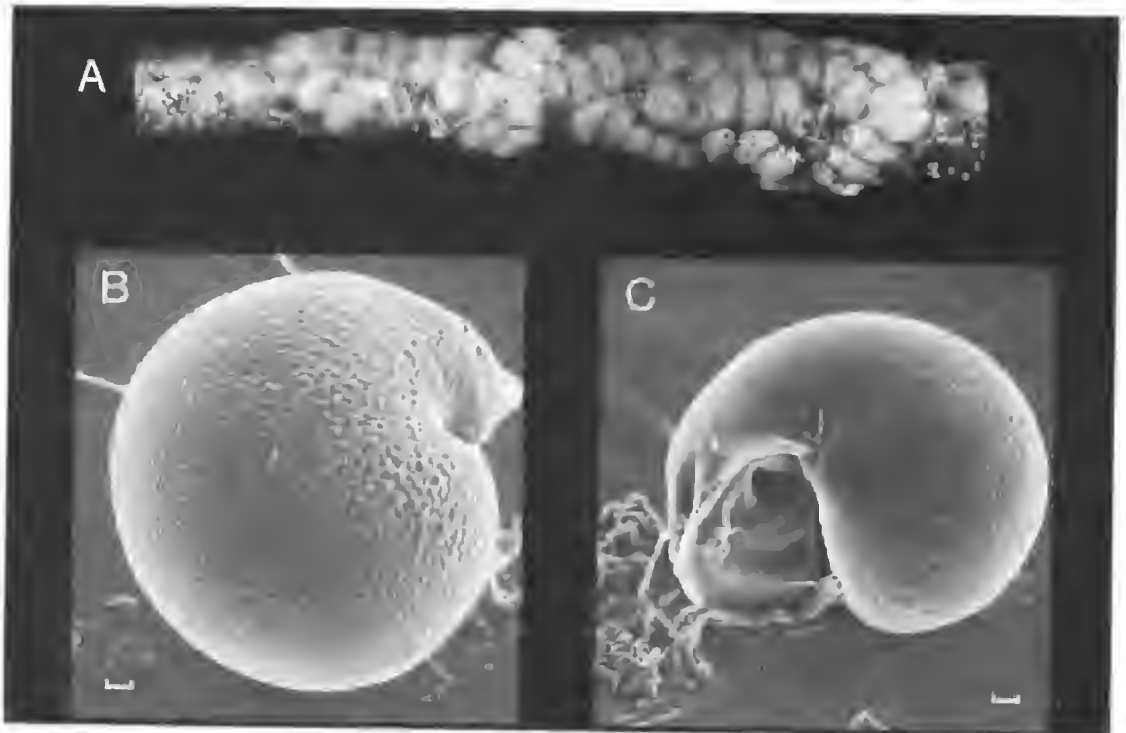


Fig. 4. *Primovula (P.) heleneae* (SAM D17973). A. egg mass on branch of *Euplexaura* sp., x 4; B. embryonic shell, dorsal view; C. embryonic shell, showing aperture and operculum, scale bar = 10 μ m.

cast, northern Spencer Gulf, S. Aust., 32°55'00"S, 137°51'24"E, E. Oks, Sept. 1987 (SAM D17977).

Diagnosis: Small allied cowrie, adult length 6.70-12.60 mm, mean 9.51 mm \pm 1.2. Elongate; both ends produced. Dorsum sculptured with numerous transverse wavy striae; funiculum not prominent; aperture narrow with strong fossula; outer lip outer margin with slight to prominent terminal nodules; both canals bordered by slightly projecting terminal ridges. Shell greyish orange to brownish red; tips red to orange; dorsal bands and patches usually present, white, pale yellow to pale orange; columellar callus, outer lip and labial callus yellow to light orange; fossula pinkish white. Animal mantle lobes translucent pale greyish pink with dark red spots and small and large white papillae; foot ruby, underside with median longitudinal very pale pinkish white stripe; tentacles with white tip for $\frac{1}{4}$ length, remainder of tentacle, siphon and proboscis ruby.

Description of Holotype: (Figs 7A-D) Shell elongate; both ends produced; widest part of dorsum in posterior $\frac{2}{5}$. Dorsum sculptured with numerous transverse wavy striae; funiculum not prominent, smooth. Base somewhat concave, outer lip flat, inward sloping; parietal-columellar lip

convex; aperture narrow with a strong fossula, both sides strongly calloused. Parietal-columellar base smooth with faint transverse striae present on central inner part. Outer lip with rounded transverse ridges, becoming weaker anteriorly; inner margin smooth, outer margin with four slight nodules at posterior end, three slight and one prominent nodule at anterior end.

Anterior canal shallow "U"-shaped, slightly flaring, bordered on both sides by distinct and slightly projecting terminal ridges. Posterior canal somewhat produced, shallow "U"-shaped, strongly flaring, bordered on both sides by distinct and slightly projecting terminal ridges, outer lip ridge terminating in a nodule, parietal-columellar lip ridge with two nodules, one terminal.

Shell orange red, anterior and posterior tips bright red; light yellow median band across widest part of dorsum, continuing onto base; light yellow diffuse band midway between median band and posterior end, continuing onto base; light yellow patch almost midway between median band and anterior end. Outer lip and labial callus yellow; columellar callus translucent yellow with dorsal colour pattern visible. Interior of posterior and anterior canals red, becoming orange red at very tips. Fossula pinkish white.

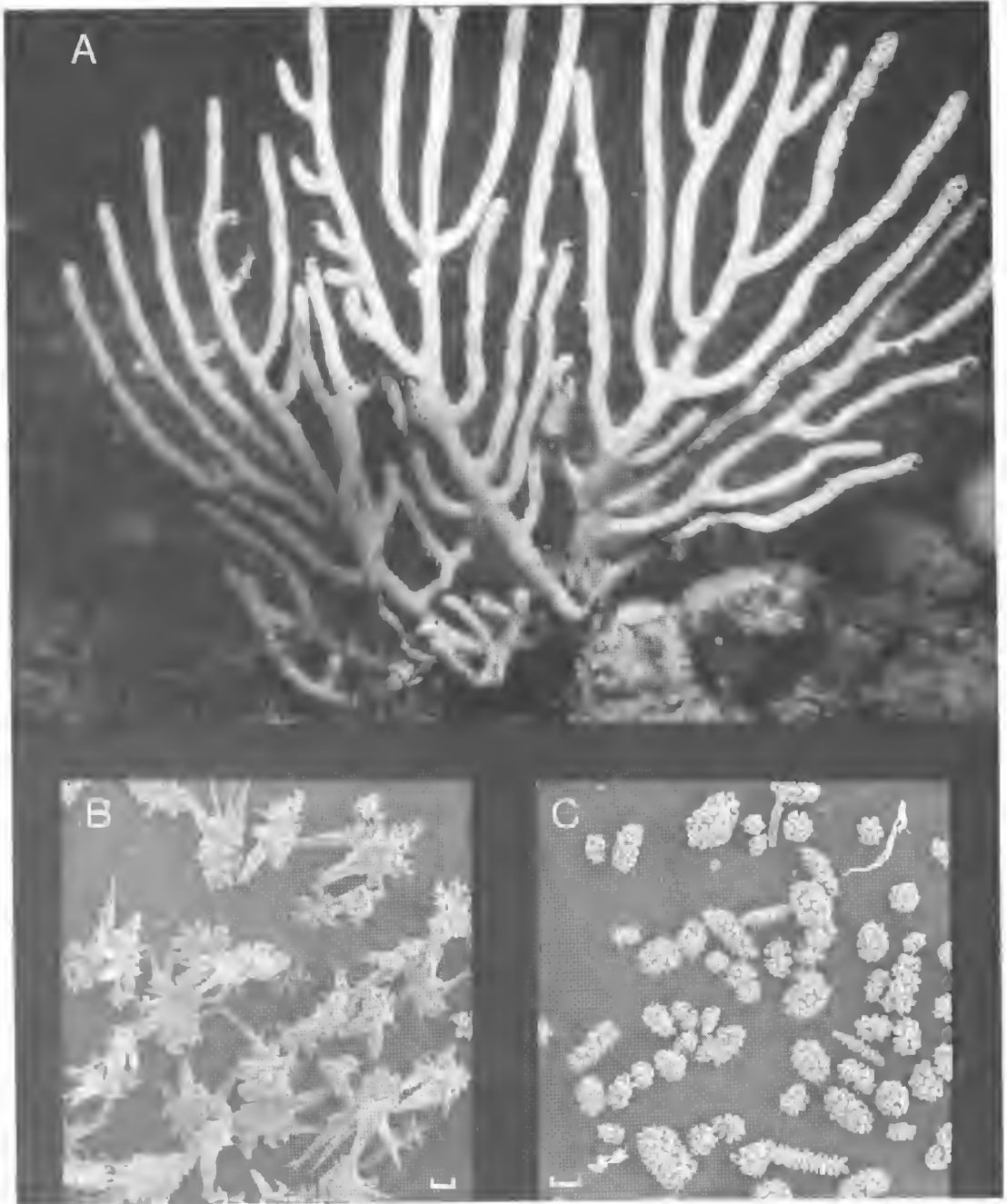


Fig. 5. A. *Euplexaura* sp. colony in situ, $\times 0.8$; B. *Echinogorgia* sp. spicules, scale bar = $100\ \mu\text{m}$ (SAM H356); C. *Euplexaura* sp. spicules, scale bar = $100\ \mu\text{m}$ (SAM H355).

Etymology: "Cruentus" (L.) meaning bloody, pertaining to the main colour of the shell and the animal.

Additional Characters from Paratypes: Animal mantle (Fig. 2) lobes translucent pale greyish pink

with random, dark red spots, rows and groups of small, simple white papillae and occasional much larger, white, elevated, rounded papillae with wart-like knobs, mantle more opaque white at base of papillae. Foot uniform ruby, underside of foot with median, longitudinal, very pale pinkish white stripe;



Fig. 6. *Echinogorgia* sp. colony in situ, $\times 0.75$.

anterior dorsal foot with series of prominent, vertical lamellae, becoming less distinct posteriorly, disappearing about $\frac{1}{3}$ length of foot from anterior end. Tentacles with white tip for $\frac{1}{4}$ length, remainder ruby with basal $\frac{1}{6}$ from eye swollen. Siphon and proboscis ruby.

Radula (Fig. 7F) with central teeth narrow at base, with large, broad, flat heads, outer edge with many perpendicular, sharp cusps, central cusp very large, tapering apically to sharp point, with sharp, lateral denticle on either side at about half length; with five or six small cusps on either side of central one.

First lateral teeth elongate, strongly curved, heads tricuspidate, cusps uneven, central cusp largest. Second lateral teeth elongate with broad, flat heads, heads with eight long, curved, sharp-tipped cusps.

Variation: Paratypes differ from the holotype in size, shell colour and sculpture (Fig. 7E). Shell colour is from greyish orange to brownish red; anterior and posterior tips red to orange; dorsal bands and patches white, pale yellow to pale orange, and vary from very prominent (often forming three distinct bands) to almost absent, median band being most conspicuous; columellar callus, outer lip and labial callus yellow to light orange.

Funiculum varies from smooth to with up to five weak nodules on inner edge. Outer lip outer margin nodules vary from very slight with one prominent nodule at anterior end, to three prominent nodules at posterior and two prominent nodules at anterior end. Posterior end usually much more produced in small specimens, almost rostrate. Posterior canal parietal-columellar lip ridge occasionally with three or four nodules.

Range: Northern Spencer Gulf, S. Aust.

Habitat: On fans of the gorgonian coral *Echinogorgia* sp. (Cnidaria: Octocorallia: Paramuriceidae), in areas of strong tidal movement.

Comparison with other species: The new species belongs in *Crenavolva*, which is distinguished from other genera in the Ovulidae by the small, elongate shell with median angulation, narrow, produced but truncate ends, dentate, curved aperture, striate dorsum and ridged outer lip (Cate 1974). *C. cruenta* most closely resembles *C. striatula* (Sowerby, 1828) and *C. verconis*, the congeners recorded from Australia. Cate (1973a) records two subspecies from Australia, *C. s. traillii* (A. Adams, 1855) and *C. s. tinctura* (Garrard, 1963), both from Queensland. *C. cruenta* can be distinguished from *C. striatula* and *C. verconis* by its narrower, more elongate form, more produced ends, the shape of its more elongate aperture, and shell colour pattern.

Remarks: The specific identity of the host gorgonian coral (*Echinogorgia*; P. Alderslade pers. comm. SAM H356) could not be determined; the red thorn scale spicules (Fig. 5B) are typical for the genus. In northern Spencer Gulf, colonies of this species (Fig. 6) are sparsely branched fans in one plane, attached by a slightly thickened base to shells, fragments or pebbles in the substrate; a poorly sorted, silty, shelly sand. Colonies are relatively small (ca 15 cm high), and appear much more tolerant of silt than *Euplexaura* sp., being widely

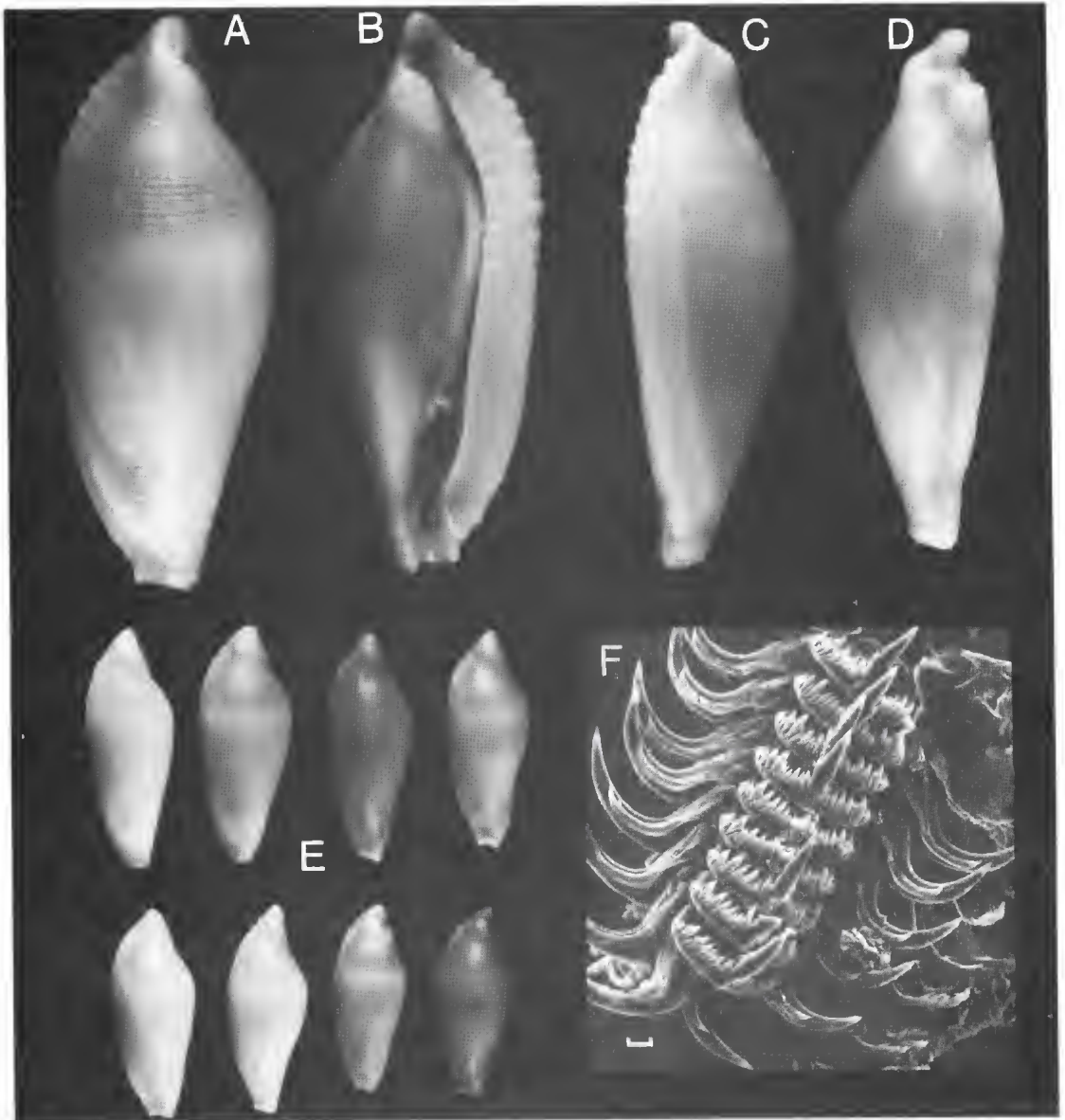


Fig. 7. *Crenavolva cruenta* sp. nov. holotype (SAM D18431), A. dorsal view, x 6.6; B. ventral view, x 6.6; C & D. lateral views, x 6.6; E. size and colour pattern range, paratypes, x 2.25 (SAM D18437); F. radula, paratype, scale bar = 10 μm (SAM D18433).

but patchily distributed in 10–20 m of water, often in quite high densities (up to 20 colonies/m²). When *C. cruenta* is present, each *Echinogorgia* sp. colony usually hosts one to three individuals. From observations made in daylight, the host's polyps are usually withdrawn on all or most of the colony when *C. cruenta* is present. Orientation of the shell is always with the longitudinal axis parallel to the branches of the host, with no observed preference for a head up or head down attitude. No particular

position on the host is favoured, and adults and juveniles are present together.

Colour pattern and form of the extended mantle lobes of *C. cruenta* are almost identical to *Echinogorgia* sp. The background colour of the gorgonian coral is red: the polyps are reddish orange when withdrawn, yellow when extended. The thorn scale spicules in *Echinogorgia* sp. protrude through the surface of the colony, giving it a rough texture. These protruding spicules help retain a ragged layer

of mucus and detritus upon the surface; this mucous layer is white, and patchily masks the red background colour. The pattern of reddish brown patches and white papillae on the mantle lobes of *C. cruenta* mimics the ragged mucus on the gorgonian coral, and an animal with the mantle lobes fully extended is very well camouflaged on its host. The very close mimicry of *C. cruenta* to its host suggests that it is an obligate predator and that its distribution is limited by that of *Echinogorgia* sp. The distances between colonies of *Echinogorgia* sp. (often <0.5 m) and the suitability of *C. cruenta*'s camouflage suggest that the latter would be able to move across the substrate between colonies, so dispersal is probably only partly by a free-swimming veliger.

Discussion

The generic names used in this paper follow the system and modifications proposed by Cate (1973a, 1973b, 1974). The distinctions between some of the genera used there are inadequate.

The two species of Ovulidae previously named from S. Aust.: *Crenavolva verconis* and *Primovula (P.) heleneae*, are both based on damaged, dead shells. Verco (1908) had three specimens and recorded them as *Ovula formosa* A. Adams & Reeve, 1848, a species described from Bornco. The description and photographs of the holotype of *O. formosa* [= *Delonovolva formosa* (A. Adams & Reeve, 1848)] in Cate (1973a) were compared with the holotype of *C. verconis*, with the holotype and other specimens of *P. (P.) heleneae*, and with the types of *C. cruenta* and *D. formosa* was found to differ significantly from them. *D. formosa* is bright purple with yellow tips; the fossula is not prominent; the whole shell is much narrower overall, with a narrower outer lip than either *C. cruenta*, *C. verconis* or *P. (P.) heleneae*, and a more pointed posterior tip than either *C. cruenta* or *C. verconis*, and which lacks the basally projecting terminal knob of *P. (P.) heleneae*.

Cotton & Godfrey (1932) described Verco's specimens as a new species, *Prasimnia verconis*. Their description obviously was based on all the specimens, although the holotype is clearly defined as the shell from St Francis Island (SAM D13476, = D10174). Cate (1973a) re-examined the types of *P. verconis*, which now consisted of two specimens, (one specimen of the original series is missing, presumed lost), and discovered that they were not conspecific. Cate acknowledged the designation by Cotton & Godfrey (1932) of the specimen registered SAM D13476 (= SAM D10174) (very worn and faded), as the holotype of *Crenavolva verconis* (Cotton & Godfrey, 1932), and used Cotton & Godfrey's (1932) paratype (SAM D15943), a worn, faded and broken specimen, as the holotype of *Primovula (P.) heleneae*. The live collected material from upper Spencer Gulf was compared with the types of both species and, although both types are damaged, the material collected from *Euplexaura* sp. was clearly conspecific with *P. (P.) heleneae*, and all of the new material was different from the designated holotype of *C. verconis*.

According to Coleman (1981), the specimen illustrated by Coleman (1975, fig. 262) as *Neosimnia verconis* (Cotton & Godfrey, 1932) is actually a specimen of an unnamed species of *Aclyvolva*.

Acknowledgments

We are grateful to Dr B. R. Wilson for his considerable assistance and critical comments, and to Mr P. Alderslade for identification of the gorgonian corals. Mr W. Zeidler, Dr C. Watts, Dr F. E. Wells and an anonymous referee are thanked for critical comments. We thank Mr R. Thomas, Mr D. Evans, Mr M. Moore and Ms J. Young, all of Kinhill Marine Sciences, for assistance in the field. The photographs (other than Figs 1, 2, 7, 5A, 6) were taken by Mrs J. Forrest and Ms A. Rentfry (SEM). The colour plates were funded by the Research Fund of the South Australian Museum.

References

- ALLAN, J. (1956) "Cowry shells of world seas." (Georgian House, Melbourne).
- BANDEL, K. (1984) The radulae of Caribbean and other Mesogastropoda and Neogastropoda. *Zool. Verhandl. Leiden* **214**, 1-188, pls 1-22.
- CATE, C. N. (1973a) A systematic revision of the recent cypracid family Ovulidae (Mollusca: Gastropoda). *Veliger Suppl.* **15**, 1-116.
- (1973b) The Ovulidae: Replacement names for four ovulid homonyms. *Veliger* **16**(2), 238-239.
- (1974) The Ovulidae: A key to the genera, and other pertinent notes (Mollusca: Gastropoda). *Ibid.* **16**(3), 307-313.
- COLEMAN, N. (1975) "What shell is that?" (Hamlyn, Sydney)
- (1981) "What shell is that? 2nd Edition." (Lansdowne, Sydney).
- COTTON, B. C. (1935) "Combing the southern seas." (Rigby, Adelaide).
- (1959) "South Australian Mollusca: Archaeogastropoda." (S. Aust. Govt Printer, Adelaide).
- & GODFREY, F. K. (1932) South Australian shells (including descriptions of new genera and species). Part III. *S. Aust. Nat.* **13**, 35-86.
- GARRARD, T. A. (1963) New species of Mollusca from eastern Australia. *J. Malac. Soc. Aust.* **1**(7), 42-46.
- IREDALE, T. (1935) Australian cowries. *Aust. Zool.* **8**(2), 96-135.
- KORNERUP, A. & WANSCHER, J. H. (1978) "Methuen Handbook of Colour. 3rd Edition." (Fyre Methuen, London.)
- SCHILDER, F. A. (1941) Verwandtschaft und Verbreitung der Cypracacea. *Archiv Mollusk.* **73**(2/3), 57-120.
- VERCO, J. C. (1908) Notes on South Australian marine Mollusca, with descriptions of new species. Part IX. *Trans. R. Soc. S. Aust.* **32**, 338-361.